

STATE NATURAL RESOURCES  
 COMMITTEE NO. 3  
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dweinberg

**From:** Mike Koopal [mike@whitefishlake.org]  
**Sent:** Monday, January 22, 2007 10:45 AM  
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**Cc:** Dan Weinberg  
**Subject:** Natural Resources Committee request

1-22-07

Montana Senate Natural Resources Committee;

As requested by Senator Kaufmann at the Natural Resources Committee hearing last Friday, I have included a literature review documenting the effects of carbureted two-stroke marine engines. Without duplicating citations, I have broken down scientific literature into two classifications while limiting myself to ten examples from the following two categories; 1) documentation of carbureted two-stroke emissions, and 2) emissions effect to the environment and/or public health.

**1) Documentation of carbureted two-stroke emissions.**

Bannan, M. 1997. The effects of powerboat emissions on the water quality of Loch Lomond. Post-graduate annual report. Glasgow University and University Field Station, Great Britain.

Boughton, C.J. and M.S. Lico. 1998. Volatile organic compounds in Lake Tahoe, Nevada and California, July-September 1997. U.S. Geological Survey Fact Sheet 055-98.

California Air Resources Board. 1998. Unpublished data. Exhaust emissions from selected marine engines. [www.arb.ca.gov](http://www.arb.ca.gov). Sacramento, CA.

California Air Resources Board. 2001. Outboard engine and personal watercraft emissions to air and water: A laboratory study. Mobile Source Control Division, El Monte, CA.

Lico, M.S. 2004. Gasoline-related organics in Lake Tahoe before and after prohibition of carbureted two-stroke engines. Lake and Reservoir Management 20(2):164-174.

Reuter, J. et al. 1998. Concentrations, sources, and fate of the gasoline oxygenate methyl *tert*-butyl ether (MTBE) in multiple-use lake. Environ. Sci. Technol. 32:3666-3672.

San Diego County Grand Jury. 2003. Polluting Just for the Fun of It: Two-stroke engines on Mission Bay. San Diego County Grand Jury, San Diego, California.

Tahoe Regional Planning Agency. 1999. Environmental Assessment for the prohibition of certain two-stroke powered watercraft. Tahoe Regional Planning Agency, Lake Tahoe, California.

U.S. Environmental Protection Agency. 1996. Regulatory impact analysis. Control of air pollution emission standards for new nonroad spark-ignition marine engines: Office of Air and Radiation Publication ANR-443.

Whitefish Lake Institute. 2006. Unpublished. Gasoline constituent loading and motorized watercraft levels, Whitefish Lake, 2005-2006. Whitefish Lake Institute, Whitefish, Montana.

1/22/2007

## 2) Emission effect to the aquatic environment

- Allen, B., Reuter, J., Goldman, C., Fiore, M., and G. Miller. Lake Tahoe motorized watercraft report- an integration of water quality, watercraft use and ecotoxicology issues. Tahoe Research Group- John Muir Institute for the Environment, University of California, Davis and Department of Environmental Resource Sciences, University of Nevada, Reno.
- Asplund, T. 2000. The effects of motorized watercraft on aquatic ecosystems. Publ-ss-948-00. Wisconsin Department of Natural Resources, Bureau of Integrated Science Services, Madison, WI.
- Balk, L., Ericson, G., Lindesjoo, E., Petterson, I., Tjarnlund, U., and G. Akerman. 1994. Effects of exhaust from two-stroke outboard engines on fish. Nordic Council of Ministers, Copenhagen, Denmark.
- Hallock, D., and C. Falter. 1987. Powerboat engine discharges as a nutrient source in high-use lakes. USGS Res. Tech. Comp. Rep. 14-08-000-G1222-06. Washington, DC.
- Kempinger, J., Otis, K. and J. Ball. 1998. Fish kills in the Fox River, Wisconsin, attributable to carbon monoxide from marine engines. Transaction of the American Fisheries Society. 127:669-672.
- Mastran, T., Dietrich, A., Gallagher, D., and T. Grizzard. 1994. Distribution of polyaromatic hydrocarbons in the water column and sediments of a drinking water reservoir with respect to boating activity. Wat. Res. 28(11):2353-2366.
- Miller, G., Hoonhout, C., Sufka, S. Edivirisingham, V., Allen, J., Oris, T., and M. Lico. 2003. Environmental assessment of the impacts of PAH in Lake Tahoe and Donner Lake. Lahontan Regional Water Quality Control Board, Sacramento, CA.
- Schnek, J., Atkins, P., Weitzel, R., Simon, P., Posner, J., and W. Weber, Jr. 1975. Effects of outboard marine engine exhaust on the aquatic environment. Prog. Wat. Tech. 7 (3/4): 733-741.
- Tahoe Research Group. 1997. The use of two-cycle engine watercraft on Lake Tahoe: water quality and limnological considerations. Report to Tahoe Regional Planning Agency, Lake Tahoe, California.
- Warrington, P. 1999. Impacts of outboard motors on the aquatic environment. *As found in*: Lico, M.S. 2004. Gasoline-related organics in Lake Tahoe before and after prohibition of carbureted two-stroke engines. Lake and Reservoir Management 20(2):164-174.

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